Nov. 6, 1945. P. E. GARBER 2,388,478

TARGET KITE

Filed Aug. 14, 1944 3 Sheets-Sheet 1

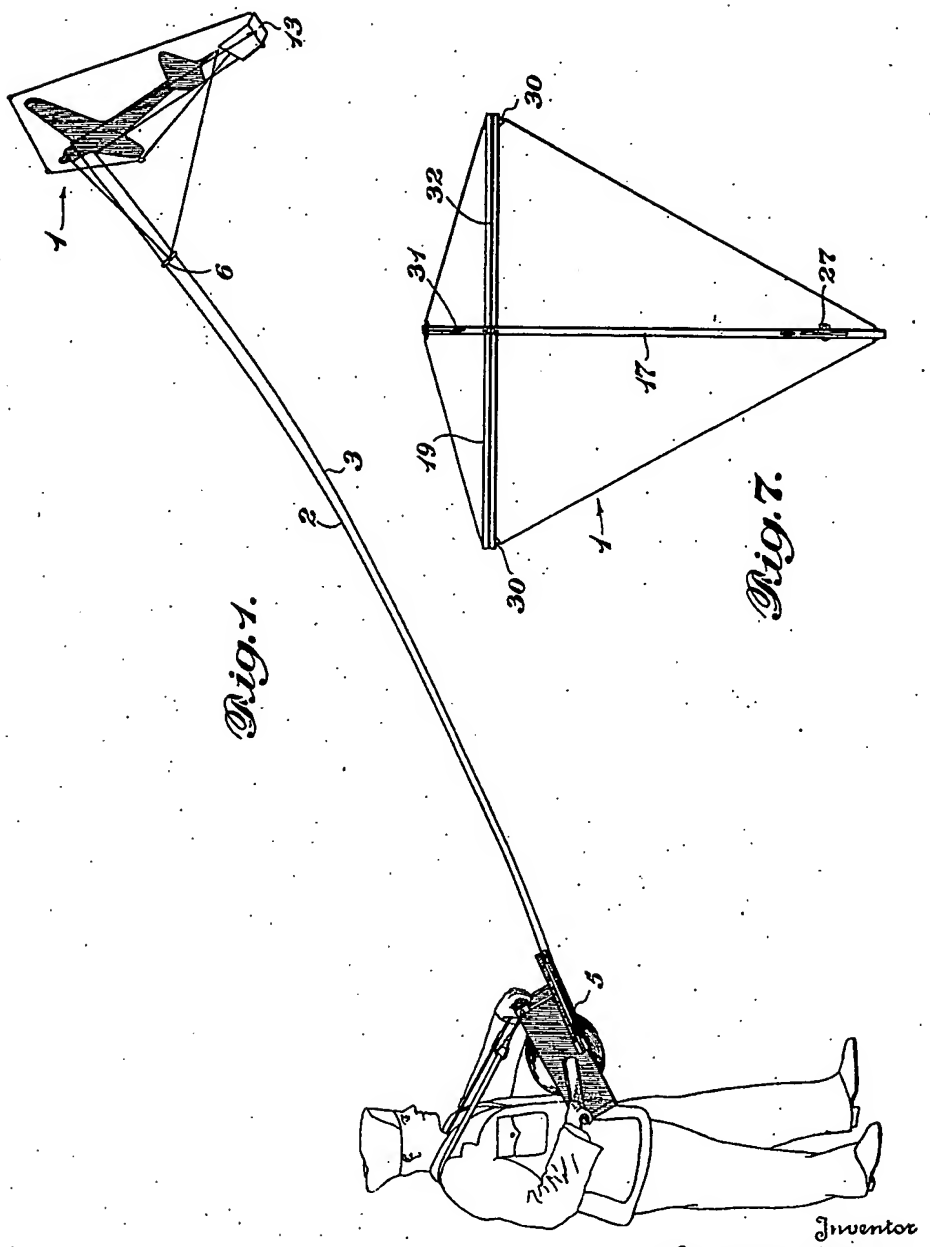

Fig. 1.

Fig. 7.

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Fig. 2.

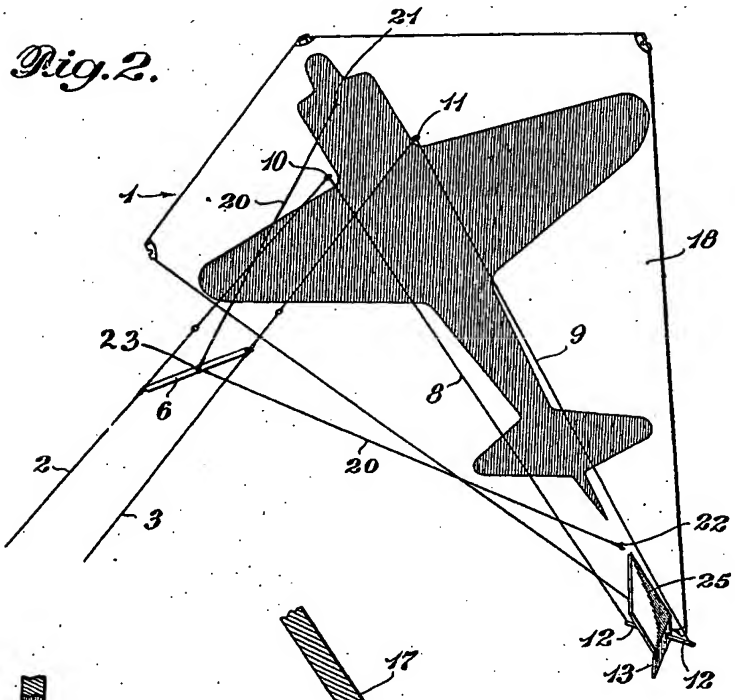


Fig. 9.

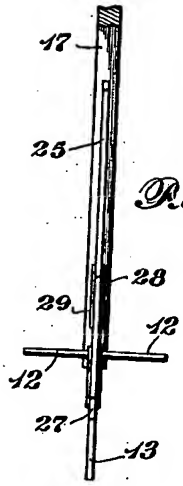
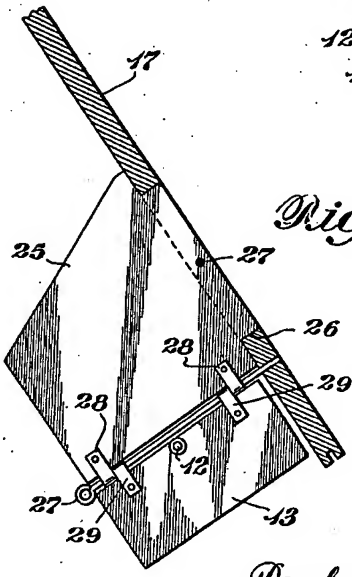


Fig. 8.



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TARGET KITE

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3 Sheets-Sheet 3

Fig. 3.

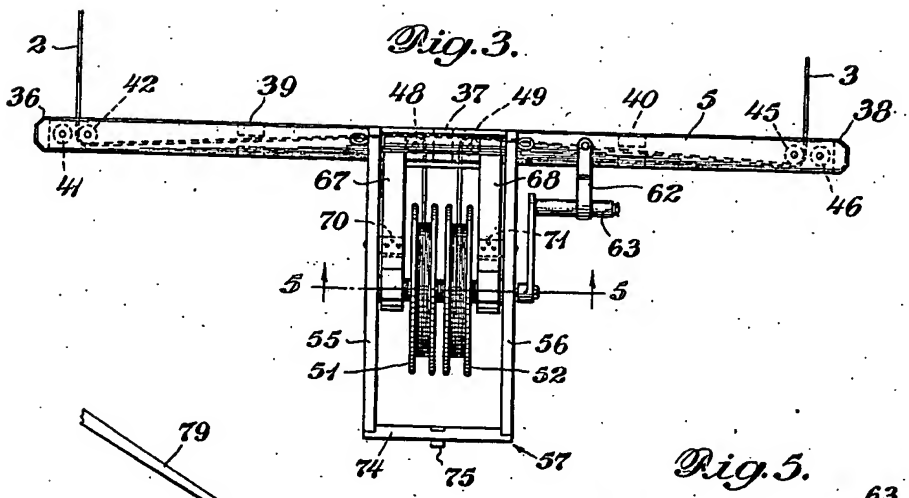


Fig. 4.

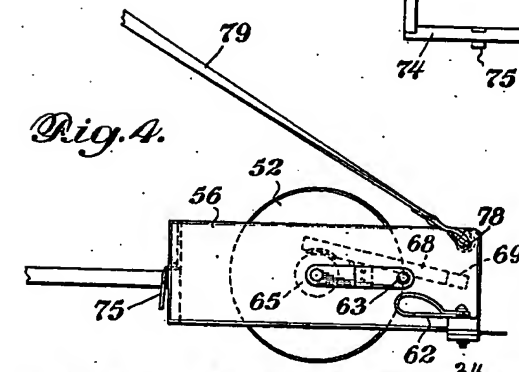


Fig. 5.

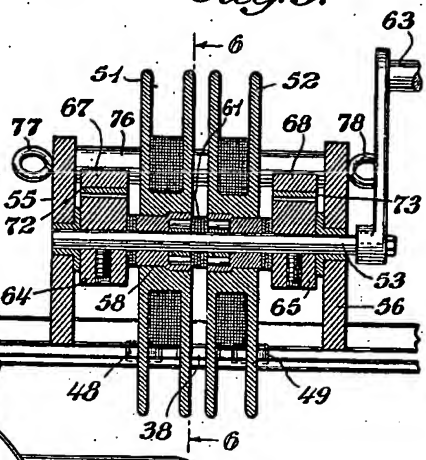
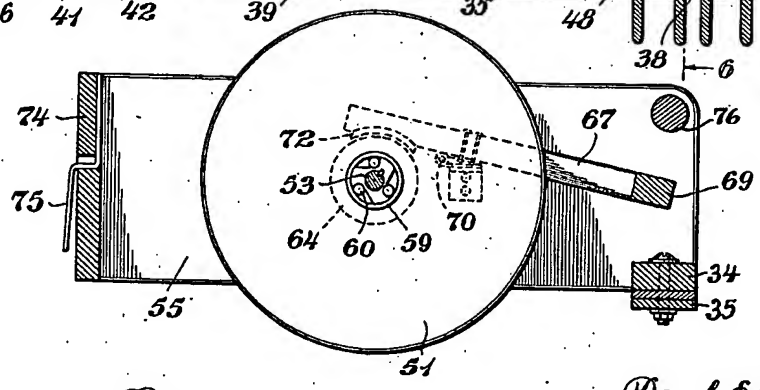


Fig. 6.



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UNITED STATES PATENT OFFICE

2,388,478

TARGET KITE

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Application August 14, 1944, Serial No. 549,469

8 Claims. (Cl. 244—153)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to kites, and in particular to those which can maneuver from the ground, together with devices for their control.

Kites have been used for sport as well as for utilitarian purposes for a great many years. Some have been designed for great lifting power and some have been designed more in regard to their beauty or oddity. Several types of maneuvering kites have been known, among those being types which could be controlled from the ground. Among the latter type are those illustrated in the Patents 1,744,529 and 1,908,325 to DeHaven.

My invention relates to maneuvering kites of the type which may be controlled from the ground by the operator. The kite and control apparatus is specifically designed to provide a maneuvering target for anti-aircraft target practice, and the kite is rapidly and easily maneuverable, making it particularly useful and successful for that purpose, however it is also suitable for signalling purposes or the like and for sport.

While the aforementioned patents to DeHaven disclose kites having some degree of maneuverability, there are differences in structure and control mechanism in my device which provide a much more speedy and maneuverable target. With my apparatus, the kite can be made to describe loops, vertical or horizontal figure eights, steep dives and climbs, ordinary turns, and combinations of these maneuvers. The operator may stand in one place on the ground if there is sufficient wind to fly the kite, or he may ride a vehicle or other moving platform in order to provide relative wind to fly the kite or in order to tow the target past a long line of guns while maneuvering it. The simplicity, positiveness, and ease of operation of the control means makes it possible to operate the kite from such a moving platform.

It is, accordingly, the major object of my invention to provide a maneuvering aerial target apparatus for anti-aircraft gun practice wherein a maneuvering kite and controls therefor, operated on the ground, cooperate to furnish a rapidly and completely maneuverable aerial target.

Another object of my invention is to provide an improved maneuvering kite of the type controlled from the ground by the kite strings.

It is another object of my invention to provide an improved apparatus for controlling a maneuvering kite from the ground by the kite strings.

Other objects will become apparent as the description proceeds in connection with the attached drawings, wherein:

Figure 1 is a perspective view of the kite in operation and showing the operator using the reel to control the kite.

Figure 2 is an enlarged perspective view of the kite of Figure 1.

Figure 3 is a plan view of the reel shown in Figure 1.

Figure 4 is a side elevation of the reel shown in Figure 1.

Figure 5 is a partial sectional view along the line 5—5 of Figure 3, looking in the direction of the arrows.

Figure 6 is a partial sectional view along the line 6—6 of Figure 5, looking in the direction of the arrows.

Figure 7 is a back or top view of the kite.

Figure 8 is a partial sectional view showing details of the fin and rudder and the method of attaching them to the mast of the kite.

Figure 9 is a view of the structure shown in Figure 8, as seen when viewed from the left of Figure 8.

Figure 1 shows the kite 1 in flight under the control of an operator on the ground. The kite is a two-stick, diamond shaped "Eddy" pattern type. Operation is by means of two lines 2 and 3 which extend up to the kite from the ends of a control bar 5 held horizontally by the operator. The control bar is of substantial length so that by moving one of its ends towards or away from the kite a relatively large movement of the line 2 or 3 will occur. A length of four feet for the control bar has been found to be effective, but this figure is not intended by way of limitation. A reel apparatus, shown best in Figures 3 to 6 is combined with this bar for most effective operation.

Near the kite, the lines 2 and 3 are connected to the opposite ends of a horizontal bridle stick 6 as shown best in Figure 2. Control cords 8 and 9 extend from the bridle stick, passing through a pair of screw eyes 10 and 11 and thence to the ends of a tiller bar 12 on a rudder 13 which is pivoted about an axis substantially perpendicular to the mast 17 (Figures 7–9) of the kite. The screw eyes 10 and 11 are screwed through the kite covering 18 into the bottom of the spar 19 (Figure 7), at equal distances from the mast 17, the total distance between the eyes being substantially equal to the length of the bridle stick 6.

A bridle line 20 is fastened at its ends to screw eyes 21 and 22 which pass through the cover 18

and screw into the bottom of the mast as shown clearly in Figure 2. With a kite having a mast 17 which is 5 feet 1 inch long the spar 19 is bolted thereto at a distance of 9 inches from the forward or top end of the mast. The screw eye 21 is located 4½ inches forward of the spar, and the screw eye 22 is 13 inches forward from the bottom of the mast. The spar 19 is five feet long, and the screw eyes 10 and 11 are spaced 6 inches on either side of the mast since the bridle stick is 12 inches long. The bridle line 20 is 80 inches long, and fastened at each end to the screw eyes 21 and 22. At a point 23, which is 30 inches from where the bridle line is fastened to screw eye 21, it is fastened to a screw eye at the mid-point of the bridle stick as shown in Figure 2. The length of the bridle line 20, the positions of the eyes 21 and 22, and the position of the point 23 are important because they determine the angle of attack of the kite.

Since the lines 2 and 3 are fastened to the ends of the bridle stick and the bridle line 20 is fastened to the middle of the stick, the tension or pull in the bridle line 20 when the kite is flying is evenly distributed to the two lines 2 and 3. The control cords 8 and 9 are not intended to take any of the tension in the lines 2 and 3 under most conditions, and for that reason when the bridle line 20 is under normal tension the control cords 8 and 9 are adjusted with a little slack.

Details of the rudder 13 and vertical fin 25 to which it is attached are shown in Figures 8 and 9. The vertical fin has a portion 26 which extends through a slot in the mast 17, being fixed therein by a bolt 27 which passes through the portion 26 and the mast.

The rudder 13 is hinged to the rear of the fin 25 by means of a pintle 27 which passes through hinge straps 28 and 29 fastened to the fin and rudder respectively. The tiller bar 12 is suitably fastened to the rudder near the leading edge, projecting from each side of the rudder a substantial distance; in the case of a kite of the dimensions given above, the tiller bar will have a length of 5 inches from end to end. The rudder can be moved through an angle of approximately 90 degrees to either side of its mid-position, whereupon it strikes the side of the vertical fin which provides a stop.

The cover may be applied to the kite in any convenient manner. In the embodiment shown the ends of the mast 17 and spar 19 are slotted to receive a boltrope 30 which passes loosely within a hem in the periphery of the cover. At the corners the boltrope is exposed so that it will slip into the aforementioned slots. The boltrope is tensioned by drawing its two free ends through the slot in the forward part of the mast and then fastening them in any suitable manner as by clamping them under a washer and wing-nut 3.

The spar is bowed by tightening the bowing line 32 (Figure 7) which is attached to its ends. The amount of bow is determined by the strength of the wind in which the kite is flown.

In view of the fact that the cords 2, 3, 8, 9, 20 and 32 change in length with weather conditions, age, tension, etc., means should be incorporated in their connections to the kite whereby their length can be easily adjusted.

As indicated in Figure 2 the outline of an airplane is painted on the cover of the kite. Preferably the outline is in black and the rest of the cover is the same color as the sky, by which device the airplane outline makes a more realistic target for anti-aircraft target practice.

While the kite may be controlled with plain stick substituted for the control bar 5 shown, it is much more convenient to use the combination control bar and reel apparatus to be described below. If a plain stick is used it should be about 4 feet long and the lines 2 and 3 tied to its opposite ends. It will be understood that by manipulating the stick to pull line 2 or 3 towards the operator the rudder 12 is shifted to make the kite turn one way or the other.

The control bar 5 and reel shown generally in Figure 1 is shown in enlarged detail in Figures 3 to 6. Two wooden sticks 34 and 35 of equal length are fastened together in parallel but spaced alignment, there being separators 36, 37 and 38 at their ends and at their mid-point. Intermediate separators 39 and 40, have passages therethrough to permit the lines 2 and 3 to pass through them and whereby these separators also act as guides.

Adjacent each end, between the sticks 34 and 35 are pairs of spaced pulleys 41, 42 and 45, 46. On either side of the separator 38 are pulleys 48 and 49. The lines 2 and 3 pass between the pulleys 41, 42 and 45, 46 and into the space between the sticks 34, 35, thence to the pulleys 48 and 49, and thence to the reels 51 and 52, as shown in Figure 3.

The reels are mounted on a shaft 53 which is journalled in the sides 55 and 56 of a frame 57 which is attached to the control bar at its mid-point, straddling the pulleys 48 and 49. Each pulley is fixed to an outer shell 58 of a free-wheeling clutch, the shell being rotatably journalled on the shaft 53. Within each shell is a clutch hub 59 having wedge shaped pockets in its periphery, each pocket containing a roller 60. Each clutch hub is fixed to the shaft 53, and when the shaft is rotated clockwise as viewed in Figure 6 it will rotate the reel 51 clockwise. Reel 52 will be simultaneously rotated by its clutch, as will be understood. The two reels 51 and 52 are slightly spaced by separating washers 61. A crank having a handle 63 is fixed to the end of shaft 53. A strap 62, which is fastened to the top of the control bar 5, may be slipped over the handle 63 to hold it when desired.

Brake drums 64 and 65 are fixed to the shaft 53, one on each side of the pair of reels. A brake yoke having side arms 67 and 68 and a connecting handle 69, is mounted for pivotal movement with respect to the reel frame 57 by means of the hinged mountings 70 and 71 which are fastened to the frame sides 55 and 56. At their rear ends the brake yoke side arms 67 and 68 are provided with brake linings 72 and 73 which are curved to fit the surface of the brake drums. When the brake handle 69 is raised by the operator the brake linings 72 and 73 will be simultaneously pressed against the drums to stop the rotation of the shaft 53. As the brake is used to stop rotation of the reels when paying out the lines 2 and 3, during which time the reels are rotating counter-clockwise as viewed in Figure 6, it will be apparent that stopping the shaft 53 by the brake will stop the reels due to the wedging action of the rollers 60.

The frame sides 55 and 56 are joined at their rear end portions by an end wall 74 to which is fastened a hook 75 adapted to be hooked behind the belt of the operator. At their forward end the sides 55 and 56 are fastened at their bottom to the control bar 5, there being a connecting brace 76 connecting their forward and upper portions. Screw eyes 77 and 78, fastened to the frame

sides at their forward and upper end, provide fastenings to which are attached the ends of a shoulder harness 79 which passes over the shoulders of the operator. By means of the hook 75 and the shoulder harness 79 the whole reel and control bar are suspended on the front of the operator and his hands are free to manipulate the reels, brake, crank handle, and the control bar 5. Normally, the operator can rest his right hand on the crank handle, and his left hand on the brace 76 at the front of the frame 57. He can easily reach the fingers of his left hand down to grasp the brake handle 69 so that he can raise the handle to apply the brake. The brake is useful not only in slowing the running out of the flying lines as the kite ascends, but can be often used to hold the lines taut to test their evenness while either drum is being compensated to take up slack in the lines 2 or 3. The brake should always be used to arrest the revolving reels after paying out line. Grabbing of the rotating handle for that purpose puts a strain on the reel and kite.

The necessity for the differential action of the two reels becomes apparent when the kite is flown. Then it is seen that although the reel is designed with narrow drums, and some lateral play while cranking, so that the incoming and outgoing lines will shuttle back and forth to avoid piling up on one side or the other of the reels, even so, there will be unevenness, often too great to be compensated by yawing the control bar 5. Moreover, the yawing action should be used only for maneuvering of the kite by moving the bridle stick and consequently the rudder. Therefore when the kite is being flown the length of the lines 2 and 3 should be adjusted by manipulating the individual reels 51 and 52 until the lines 2 and 3 are of the same length, with the bridle stick 6 and the control bar 5 both parallel to the kite.

There are two methods of using the free wheeling clutches to adjust the length of the lines. First: if the crank handle 63 has been secured in the crank handle strap 62, push forward on the top of the winding drum of whichever line is slack. Second: if the crank handle is being held in the hand, use the other hand to hold the drum of the line that is slack, and back off on the handle for a portion of a turn, then free the drum and wind both with a forward motion of the crank.

In flying the kite, as mentioned above, a yawing motion of the control bar 5 causes a yawing of the bridle stick 6 and a consequent movement of the rudder. The relative proportions of the control bar 5, the bridle stick 6 and the tiller bar 12 are therefore important because with the elongated control bar a relatively small yawing motion thereof results in a much larger or magnified motion of the bridle stick.

One of the additional advantages of the control mechanism used with the described kite is an effect which results when the control bar 5 has been yawed to such an extent that the rudder 13 has moved to an extreme position, where it is stopped by the engagement of the tiller bar with the vertical fin 25. When this occurs, the control cord 8 or 9, as the case may be, is placed under tension. Since the screw eyes 10 and 11 are spaced a distance from the mast it will be seen that the application of the above described tension to the cord 8 or 9 will apply a force to the kite to the side of the mast and on the same side thereof as that towards which the rudder is turned. The direction of this force is such as to incline the kite surface toward the direction of pull so that it reacts like the sail of a boat.

The form of kite shown is inherently stable. The wind pressing the fabric of the cover on each side of the mast forms the cover along that line into a vertical keel. The vertical fin 25 augments this keel surface and, being at the bottom, adds to the steadiness. The addition of the rudder provides a means of variable pressure against the air stream flowing along the keel and steers the kite. The recovery of the kite from each maneuver is facilitated by its stableness and its natural tendency to climb. It is to be understood that the specific dimensions for the kite, as given in the preceding part of the description, are by way of example only, and are not meant as limitations.

It will be understood that the above description and accompanying drawings comprehend only the general and preferred embodiment of the invention and that various changes in details of construction, proportion and arrangement of parts may be made within the scope of the appended claims and without sacrificing any of the advantages of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon or therefor.

What is claimed is:

1. A maneuvering kite and control comprising a substantially diamond shaped kite having a mast and a spar fastened together and a cover therefor; a bridle line fastened to the mast at points adjacent its ends; a bridle stick connected at its mid-point to said bridle line at a point closer to the upper end thereof than the other; a rudder pivotally attached to said mast adjacent the rear end thereof; a tiller bar attached to said rudder; control cords connecting the ends of said bridle stick to the ends of said tiller bar; spaced guides on said spar through which said control cords pass; means limiting the movement of said rudder to approximately 90 degrees on either side of its neutral position; a control bar adapted to be used by an operator on the ground; and lines connecting the ends of said bridle stick to the ends of said control bar.

2. A maneuvering kite and control comprising a kite having a longitudinal keel; a bridle line fastened to the kite at points adjacent the ends of said keel; a bridle stick connected at its mid-point to said bridle line at a point closer to the upper end thereof than the other; a vertical rudder pivotally attached to the kite adjacent the lower end of said keel; control cords connecting the ends of said bridle stick to said rudder; transversely spaced guides attached to said kite through which said control cords pass; means limiting the movement of said rudder to approximately 90 degrees on either side of its neutral position; a control bar adapted to be operated by an operator on the ground; and lines connecting the ends of said bridle stick to the ends of said control bar.

3. A maneuvering kite and control comprising a kite having a longitudinal keel; a vertical fin fastened to the kite adjacent the lower end of said keel; a bridle line fastened to the kite at points adjacent the ends of said keel; a bridle stick connected at its mid-point to said bridle line at a point closer to the upper end thereof than the other; a vertical rudder pivotally attached to the kite adjacent the lower end of said vertical fin, for movement about an axis substantially perpendicular to said keel; a tiller bar pro-

jecting from either side of said rudder and providing stop means to limit the movement of said rudder to approximately 90 degrees to either side of its neutral position by engaging the said vertical fin; a pair of transversely spaced guides fastened to said kite on either side of said keel and lying in a plane substantially perpendicular to said kite and passing through the mid-point of said bridle stick; the distance between said guides being substantially the same as the length of said bridle stick; a pair of control cords connecting the ends of said bridle stick to the ends of said tiller bar, each cord passing through one of said guides and the length of said cords being such that with said rudder in neutral position said bridle stick will be parallel with said kite; and a pair of lines connected to the ends of said bridle stick and adapted to be moved by an operator on the ground, whereby said bridle stick and rudder are shifted to maneuver the kite.

4. The device claimed in claim 3 wherein a control bar several times the length of said bridle stick is connected to the ends of said last mentioned pair of lines, whereby the kite may be maneuvered by yawing the control stick.

5. A maneuvering kite and control comprising a kite having a rudder pivotally attached thereto and movable about a substantially vertical axis; a pair of transversely spaced guides attached to said kite; a bridle stick pivotally attached to said kite at a point substantially spaced therefrom; a control cord attached to each end of said bridle stick and passing through one of said guides, the other end of each cord being attached to said rudder; means limiting the movement of said rudder to approximately 90 degrees on either side of its neutral position; a control bar adapted to be operated by an operator on the ground; and a pair of lines connected to the ends of said bridle stick and said control bar.

6. The device described in claim 5 wherein said control bar has mounted thereon a pair of reels; each of said last mentioned lines passing from the end of said control bar to one of said reels; a shaft on which said reels are mounted; a crank for rotating said shaft; and a free-wheeling clutch between said shaft and each of said reels, whereby said reels may be rotated simultaneously or independently.

7. A control device for a maneuvering kite comprising a control bar of substantial length; a pulley adjacent each end of said bar; a frame attached to said control bar substantially at the center thereof; a shaft rotatably mounted on said frame; a crank fixed to said shaft; means holding said crank and shaft against rotation; a pair of reels rotatably mounted on said shaft; a free wheeling clutch drive between each reel and said shaft; a brake means operable to stop the rotation of said shaft and said reels; and pulley means adjacent the center of said control bar and at the ends thereof to guide flexible lines from said reels to the ends of said control arm.

8. The device described in claim 7 wherein means are provided to fasten the back of said frame to the belt of an operator; and harness means attached to the front of said frame and operable to pass over the shoulder of the operator, whereby said frame is suspended from the operator to allow him to use his hands to operate said crank, brake, and reels.

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